MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210 & TERM ID 2215)

EET2166 – INTRODUCTION TO ELECTRICAL POWER AND MACHINES

(ME)

18 FEBRUARY 2023
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 4 pages including the cover page with 4 Questions only.

2. Attempt **ALL** of the questions . All questions carry equal marks and the distribution of the marks for each question is given .

3. Please write all your answers in the Answer Booklet provided .

Question 1

(a) Figure Q1 shows a Y-Δ three-phase system, find

(i) the phase angles θ_2 and θ_3 for phase sequence ABC [2 marks]

(ii) convert the Δ -load impedances to Y-equivalent impedances and draw the single- phase equivalent circuit of the system [3 marks]

(iii) the total average power, reactive power and apparent power of the load [7 marks]

(iv) the total average power and reactive power of the whole system. [6 marks]

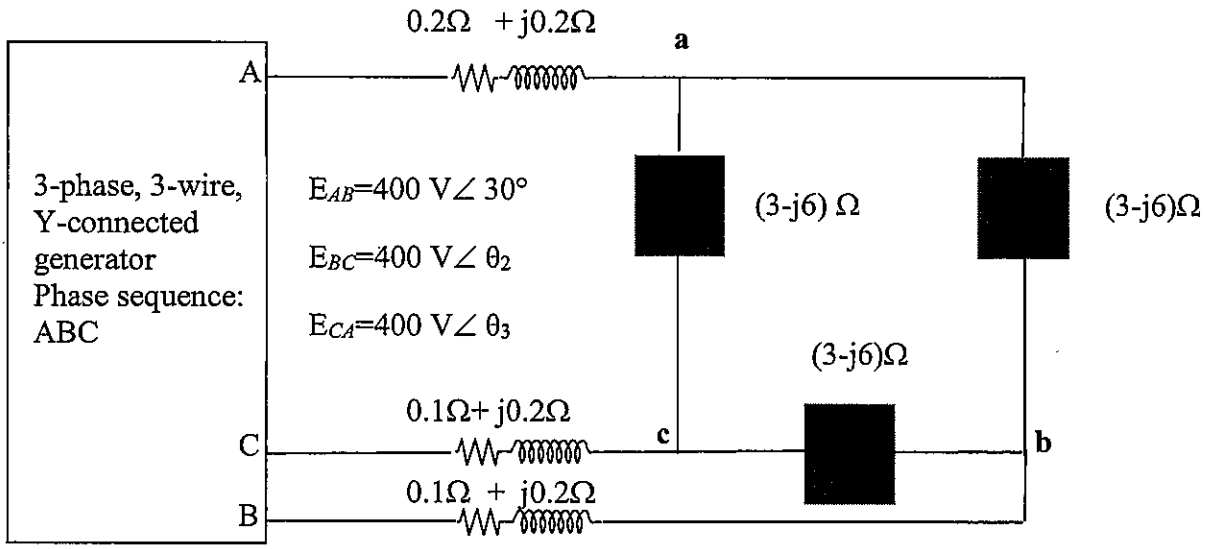

Figure Q1

(b) A 4-pole shunt generator having 676 lap connected armature conductors runs at a speed of 800rpm and supplies a load resistance of 10Ω at the terminal voltage of 250V. The armature and field resistances are 0.28Ω and 100Ω respectively. Calculate the following:

(i) the armature current, [3 marks]

(ii) generated emf and [2 marks]

(iii)the flux per pole [2 marks]

Question 2

(a) A 250V, 7.5kW, DC shunt motor is running at 1000rpm on full load with 85% efficiency. The armature and field resistances are 0.4Ω and 100Ω respectively. If the speed is raised to 1400rpm keeping torque constant, determine the extra resistance to be added in the field circuit. [8 marks]

(b) Given a 7.5kVA, 4000/115-V single phase transformer having an impedance of 40 + j150 Ω referred to the primary and the components of the excitation branch referred to the primary side are $R_C = 175k\Omega$ and $X_m = 35k\Omega$.

(i) Sketch the approximate equivalent circuit referred to the primary for this transformer. [4 marks]
(ii) Determine the primary voltage, Vp for the equivalent circuit if secondary voltage, Vs is set at 115V and the load is 0.8 pf lagging. [5 marks]
(iii) Find the total loss incorporated in this transformer. [6 marks]
(iv) Determine the efficiency of the transformer for 0.8pf lagging. [2 marks]

Question 3

(a) A 4-pole, 50Hz, 3-phase induction motor develops a useful torque of 100Nm when running on full load. The rotor frequency is observed at 2Hz. It is known that the torque lost on account of friction and core loss is 7 Nm and the total core loss is given as 700W. Calculate the

(i) slip, [2 marks]
(ii) shaft power output, [4 marks]
(iii) mechanical power developed, [2 marks]
(iv) rotor copper loss, [2 marks]
(v) motor input power, [2 marks]
(vi) motor efficiency. [2 marks]

(b) A 30kW, 3-phase, 50Hz, 440V synchronous motor running at 1000rpm has a stator resistance of 0.2Ω per phase and synchronous reactance of 1.8Ω per phase. Rotational losses are estimated to be 1500W. At stator input of 45kVA, 0.8 pf leading, determine the

(i) single-phase equivalent circuit [2 marks]
(ii) back EMF, [3 marks]
(iii) stator copper loss, [2 marks]
(iv) shaft power developed and [2 marks]
(v) shaft power output. [2 marks]

Question 4

(a) Explain the basic operation of a nuclear power plant in Figure Q4. [10 marks]

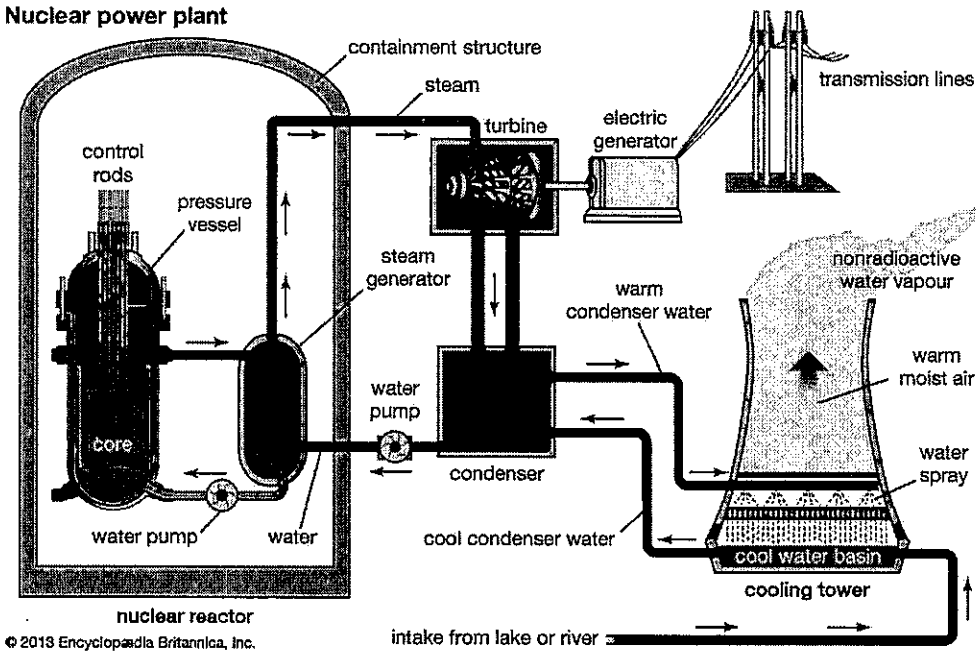

Figure Q4

(b) Discuss the THREE advantages and THREE disadvantages of nuclear power plant. [6 marks]

(c) What is current transformer and its' role in the protection system? Given that a relay is connected to power grid through a current transformer with ratio of 400:1A and the current plug setting at 125%. Assume the primary fault current is 2000 A, calculate the plug-setting multiplier. [9 marks]

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